HELENA NWS AIRPORT

LEWIS AND CLARK COUNTY

The Helena airport is located approximately 2 miles east of Helena at 46 36 21 N and 112 00 00 W (Site No. 71 on Map II-1). Elevation at the airport is 3,897 feet. Meteorological data have been collected at this site for many years by the National Weather Service.

These data, primarily collected for aviation and weather forecasting uses, consist of short-term (5 minutes or less) averages of wind speed and wind direction, as well as other meteorological parameters. Data were gathered once per hour. The data have been analyzed by Battelle Pacific Northwest Laboratories. Because of a change in anemometer height, the data set was split into two parts for analysis: January 1, 1948, through September 19, 1961; and September 20, 1961, through December 31, 1978. Only data from the more recent period were selected for inclusion in the *Montana Wind Energy Atlas.*

The data set for Helena consists of summaries of observations made every third hour from September 20, 1961, through December 31, 1978. The anemometer was mounted on a ground mast at a height of 6.1 meters. Due to the complex terrain, the site is representative only of a limited area in the Helena valley.

Average annual wind speed was 7.8 miles per hour. Average monthly wind speeds varied from 7.4 miles per hour in August through December to 9.4 miles per hour in April.

Average annual wind power was 69.0 watts/m^2. Average monthly wind power ranged from 50.0 watts/m^2 in August to 97.0 watts/m^2 in April.

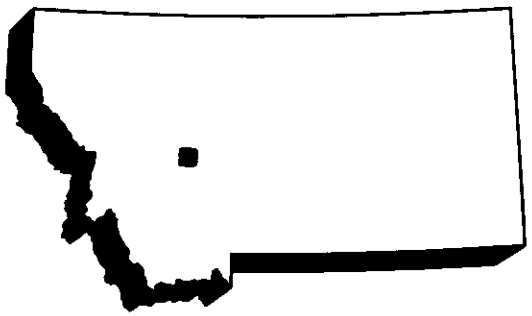


Table IV - 96

Monthly Wind Speed Distribution

LEWIS AND CLARK COUNTY - HELENA NWS AIRPORT

09/20/61 - 12/31/78

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR		
CALM (<1.1)	12.9	11.0	6.9	5.9	5.1	4.6	5.7	6.9	9.5	9.6	10.0	11.5	8.3	CALM (<0.5)	
1.1- 3.1	5.4	4.8	3.2	2.9	2.1	1.9	2.3	2.2	2.9	4.3	5.2	5.4	3.6	0.5- 1.4	
3.4- 5.4	24.1	26.5	21.2	18.5	19.1	21.9	25.3	25.8	26.4	27.7	28.1	27.0	24.3	1.5- 2.4	S
S 5.6- 7.6	18.2	18.2	19.1	19.0	21.9	23.8	25.5	24.3	22.1	21.0	20.3	19.3	21.1	2.5- 3.4	P
P 7.8- 9.8	11.3	11.3	14.0	15.6	17.2	16.1	16.7	18.1	14.5	13.2	12.4	11.0	14.3	3.5- 4.4	E
E 10.1-12.1	8.9	8.0	10.8	10.6	12.0	9.8	9.0	7.9	9.0	7.3	7.2	8.4	9.1	4.5- 5.4	E
E 12.3-14.3	5.6	5.3	6.6	7.4	6.9	6.8	4.9	4.9	5.5	4.5	4.9	5.0	5.7	5.5- 6.4	D
D 14.5-16.6	4.1	5.1	6.9	7.1	5.7	5.7	4.2	3.9	3.8	4.6	4.3	4.1	4.9	6.5- 7.4	
16.8-18.8	3.7	4.2	4.7	5.5	3.9	4.4	3.2	3.0	2.9	3.4	3.0	3.5	3.8	7.5- 8.4	M
M 19.0-21.0	2.6	2.6	3.7	3.7	3.1	2.6	1.8	1.6	1.7	2.5	2.1	2.3	2.5	8.5- 9.4	E
I 21.3-23.3	1.6	1.5	1.6	2.1	1.6	1.4	0.7	0.6	1.1	1.3	1.0	1.4	1.3	9.5-10.4	T
L 23.5-25.5	0.6	0.7	0.6	0.8	0.6	0.5	0.4	0.3	0.3	0.4	0.6	0.5	0.5	10.5-11.4	E
E 25.7-27.7	0.2	0.4	0.3	0.5	0.5	0.2	0.2	0.2	0.3	0.2	0.4	0.2	0.3	11.5-12.4	R
S 28.0-30.0	0.5	0.2	0.2	0.3	0.1	0.1	0.0	0.1	0.0	0.0	0.2	0.2	0.2	12.5-13.4	S
/ 30.2-32.2	0.2	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	13.5-14.4	/
H 32.4-34.4	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.5-15.4	S
O 34.7-36.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	15.5-16.4	E
U 36.9-38.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.5-17.4	C
R 39.1-41.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.5-18.4	O
41.4-43.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.5-19.4	N
43.6-45.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.5-20.4	D
45.9-56.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.5-25.4	
57.0-68.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.5-30.4	
68.2-79.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.5-35.4	
79.4-90.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	35.5-40.4	
>90.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	>40.4	
AVERAGE SPEED (MPH)	7.6	7.6	8.7	9.4	8.9	8.5	7.6	7.4	7.4	7.4	7.4	7.4	7.8		
AVERAGE SPEED (M/SEC)	3.4	3.4	3.9	4.2	4.0	3.8	3.4	3.3	3.3	3.3	3.3	3.3	3.5		
AVERAGE WIND POWER (WATTS/M**2)	77.0	75.0	85.0	97.0	79.0	70.0	52.0	50.0	53.0	58.0	65.0	67.0	69.0		

ANEMOMETER HEIGHT = 20.0 FEET = 6.1 METERS

SOURCE: BATTELLE PACIFIC NORTHWEST LABORATORIES

SIEBEN RANCH 1

LEWIS AND CLARK COUNTY

The Sieben Ranch 1 site is located about 25 miles northwest of Helena at 46 55 00 N and 112 13 00 W (Site No. 154 on Map II-1). Elevation at the site is about 5,600 feet. (The location and elevation are given incorrectly in earlier BPA publications.) This monitoring site was part of the Wind Regional Energy Assessment Program run by Oregon State University for Bonneville Power Administration.

The site is in an area of numerous well exposed rolling hilltops and ridges. The hilltops are smooth and the slopes are moderate to steep. The site is representative of a large area. Access to the area is excellent, with an all-weather state road to the south and west and Interstate Highway 15 to the east. Access to the site itself is by dirt road. Winter access is sometimes hampered by drifting snow.

Most of the land in the area is privately owned, though there are sections of BLM and state property. Electrical service in the area is provided by the Montana Power Company. A Montana Power ~~115~~ 100 kV line runs within 7 miles of the site, but nearest substation is outside of Helena. The nearest commercial airport is located at Helena.

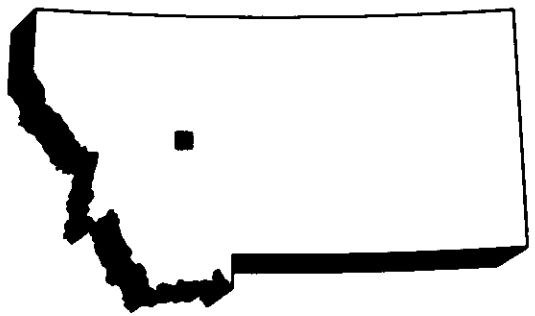
Collection of wind data began February 18, 1984 and ran through July 28, 1984. This period was too brief to serve as the basis for long term predictions, but the data were sufficiently encouraging to warrant inclusion in the *Atlas*. The anemometer height was 35 feet.

Data recovery, made with a data logger, was excellent, ranging from 88.0 percent in February to 99.9 percent in June. The overall data recovery was 97.0 percent.

Average monthly wind speeds ranged from 14.4 miles per hour in July to 20.4 miles per hour in February. Average wind speed for the five-month period was 16.7 miles per hour. The winds blew from the west nearly half the time. It is not clear whether this preponderance of wind from one direction is due to the effects of local terrain or to a malfunctioning wind vane.

Average monthly wind power ranged from 225.9 watts/m^2 in July up to 627.4 watts/m^2 in February.

Because of the short monitoring period, only the monthly wind speed distribution is reported here, even though Sieben Ranch appears to be a high potential site.



Monthly Wind Speed Distribution

LEWIS AND CLARK COUNTY - SIEBEN 1

02/18/84 - 07/28/84

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
CALM	0.0	0.4	1.4	1.7	0.4	0.6	1.8	0.0	0.0	0.0	0.0	0.0	1.1
0.1-1.0	0.0	0.8	1.6	2.1	1.5	0.8	1.5	0.0	0.0	0.0	0.0	0.0	1.5
1.1-2.0	0.0	2.1	1.1	3.6	1.2	1.1	1.7	0.0	0.0	0.0	0.0	0.0	1.8
2.1-3.0	0.0	2.1	4.1	3.1	1.3	1.7	1.5	0.0	0.0	0.0	0.0	0.0	2.3
3.1-4.0	0.0	3.7	3.4	4.1	2.7	2.1	3.2	0.0	0.0	0.0	0.0	0.0	3.1
4.1-5.0	0.0	2.5	3.4	4.9	2.2	3.6	2.4	0.0	0.0	0.0	0.0	0.0	3.3
5.1-6.0	0.0	0.8	2.0	3.1	1.9	4.7	3.6	0.0	0.0	0.0	0.0	0.0	2.9
6.1-7.0	0.0	0.8	3.5	4.4	3.3	4.9	5.0	0.0	0.0	0.0	0.0	0.0	4.0
7.1-8.0	0.0	2.1	2.8	4.4	3.3	4.0	4.1	0.0	0.0	0.0	0.0	0.0	3.6
8.1-9.0	0.0	2.1	4.5	5.2	3.9	4.0	3.8	0.0	0.0	0.0	0.0	0.0	4.1
9.1-10.0	0.0	2.5	3.4	3.0	2.1	3.9	5.3	0.0	0.0	0.0	0.0	0.0	3.5
10.1-11.0	0.0	1.6	4.5	4.7	3.3	3.2	5.0	0.0	0.0	0.0	0.0	0.0	4.0
11.1-12.0	0.0	2.9	3.5	3.7	2.4	6.0	5.0	0.0	0.0	0.0	0.0	0.0	4.1
12.1-13.0	0.0	4.5	3.2	3.7	1.8	4.9	4.8	0.0	0.0	0.0	0.0	0.0	3.8
13.1-14.0	0.0	0.8	3.4	3.6	3.4	4.3	4.2	0.0	0.0	0.0	0.0	0.0	3.6
14.1-15.0	0.0	4.1	4.0	5.6	3.1	4.3	5.0	0.0	0.0	0.0	0.0	0.0	4.4
15.1-16.0	0.0	2.1	3.5	3.3	2.4	3.8	2.7	0.0	0.0	0.0	0.0	0.0	3.1
16.1-17.0	0.0	3.7	3.8	3.1	4.0	3.2	4.4	0.0	0.0	0.0	0.0	0.0	3.7
17.1-18.0	0.0	4.1	3.8	2.9	3.3	3.1	4.8	0.0	0.0	0.0	0.0	0.0	3.6
18.1-19.0	0.0	3.7	2.7	2.0	1.8	3.6	5.4	0.0	0.0	0.0	0.0	0.0	3.1
19.1-20.0	0.0	4.1	3.0	2.3	3.0	2.4	4.1	0.0	0.0	0.0	0.0	0.0	3.0
20.1-25.0	0.0	13.6	12.1	9.0	16.3	12.4	12.4	0.0	0.0	0.0	0.0	0.0	12.5
25.1-30.0	0.0	17.7	9.2	7.6	14.4	9.5	5.0	0.0	0.0	0.0	0.0	0.0	9.7
30.1-35.0	0.0	9.1	6.9	4.9	9.2	4.5	1.5	0.0	0.0	0.0	0.0	0.0	5.6
35.1-40.0	0.0	5.8	2.7	3.1	5.2	1.8	1.1	0.0	0.0	0.0	0.0	0.0	3.0
>40.0	0.0	2.5	2.4	0.7	2.7	1.8	0.6	0.0	0.0	0.0	0.0	0.0	1.7
AVERAGE SPEED (MPH)	ND	20.4	16.9	14.7	19.7	16.3	14.4	ND	ND	ND	ND	ND	16.7
AVERAGE SPEED (M/SEC)	ND	9.1	7.6	6.6	8.8	7.3	6.5	ND	ND	ND	ND	ND	7.4
AVERAGE WIND POWER (WATTS/M**2)	ND	627.4	463.6	328.7	561.0	361.1	225.9	ND	ND	ND	ND	ND	404.3
PERCENT DATA RECOVERY	0.0	88.0	95.2	97.1	98.4	99.9	98.4	0.0	0.0	0.0	0.0	0.0	97.0

CALM	
0.1- 0.4	
0.5- 0.9	S
1.0- 1.3	P
1.4- 1.8	E
1.9- 2.2	E
2.3- 2.7	D
2.8- 3.1	
3.2- 3.6	M
3.7- 4.0	E
4.1- 4.5	T
4.6- 4.9	E
5.0- 5.4	R
5.5- 5.8	S
5.9- 6.3	/
6.4- 6.7	S
6.8- 7.2	E
7.3- 7.6	C
7.7- 8.0	O
8.1- 8.5	N
8.6- 8.9	D
9.0-11.2	
11.3-13.4	
13.5-15.6	
15.7-17.9	
>17.9	

ANEMOMETER HEIGHT = 11 METERS = 35 FEET
NUMBER OF OBSERVATIONS = 3703
PERCENTAGE DATA RECOVERY = 97.0

SOURCE: GEORESEARCH, INC.